Retrospective Summary of a Decade of Experience with Pre-surgical Functional MR Imaging

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Abstracts will be considered for both poster and platform presentations

Other

Introduction
Functional MRI (fMRI) and diffusion tensor imaging (DTI) have become standard-of-care in preoperative evaluation for mapping eloquent cortex and tracts, providing information for risk assessment and strategic surgical planning. This allows for maximization of tumor resection while minimizing postoperative deficits and shortening surgery time as well as more comprehensive preoperative counseling.
This is a retrospective summary of our experience at the University of Kentucky with over 200 patients who received advanced functional neuroimaging for presurgical planning, spanning for more than a decade.
Results
211 patients underwent presurgical functional imaging from May 5, 2005 to January 28, 2015. These were 117 males and 94 females, ranging from 7 to 84 years old (average age of 42). The indications were tumor (75%), vascular lesions (11%), epilepsy (10%), and other (3%).
The motor system was mapped with fMRI in 203 patients (96% of cases) and with DTI fiber tracking in 201 patients (95%). The language system was mapped with fMRI in 196 patients (93%) and with DTI fiber tracking in 138 patients (65%). Of those patients in whom language mapping with fMRI was attempted, 95% were successful. The vision system was mapped with fMRI in 14 patients and with DTI fiber tracking in 5 patients.
Language dominance was left-sided in the frontal lobes in >90% of cases regardless of the diagnosis. More variability was encountered when handedness is considered. In right-handed patients, language dominance was 94% left-sided, 3% symmetrically bilateral, and 3% right-sided. In left-handed patients, language dominance was 77% left-sided, 6% bilateral, and 16% right-sided. In ambidextrous patients, language dominance was 83% left-sided and 17% right-sided.
Four patients demonstrated crossed language activation. Two of these cases were tumors in the left frontal lobe, so likely mechanism is neurovascular uncoupling. The other two cases were both young epileptics, which likely reflect true reorganization, presumably related to the effects of long-standing seizure activity.
Discussion
Language lateralization is one of the most important pieces of information sought during preoperative planning and is routinely provided by fMRI. Furthermore, fMRI results are comparable to Wada testing with the added advantage of being noninvasive.
Typical expected left hemispheric language dominance is found in relatively lower rates among left-handed (77%) and ambidextrous (83%) patients. Left-handed patients with left-sided lesions have the lowest rate of left hemispheric language dominance with only 70% prevalence, which is likely potentiated by reorganization and neurovascular uncoupling. fMRI can be particularly useful in these scenarios. Crossed activation is an example of reorganization that can be encountered, particularly with epilepsy, which would be clinically unpredictable, unresolvable by even Wada testing, and yet constitutes critical information for surgical planning.